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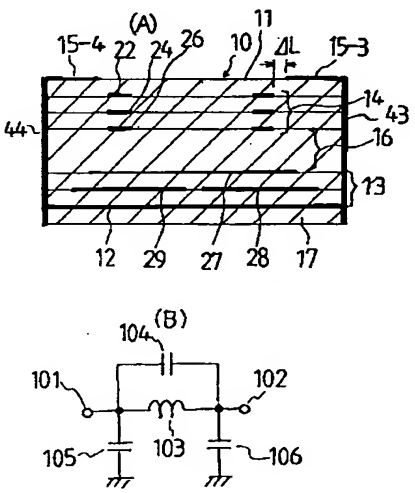
(54)【発明の名称】　高周波部品およびその製造方法

(57)【要約】
【課題】インダクタンス素子やコンデンサ等からなる受動素子を内蔵する多層基板を用いた高周波部品において、シールド機能を損なわずに小型化、実装の安定性確保、チップサイズ実装を可能とした高周波部品およびその製造方法を提供する。
【解決手段】高周波部品１０の一方の表面に外部接続電極１５を有する。高周波部品１０の外部接続電極１５が設けられた面の反対側の面の近傍でかつ高周波部品の内部に接地電極１２を設ける。



１０：高周波部品、１１：多層基板、１２：接地電極
１３：コンデンサ部、１４：コイル部
１５－３、１５－４：外部接続電極
１６：スペース層、２２、２４、２６：コイルの電極
２７～２９：コンデンサ電極、１０１、１０２：端子
１０３：インダクタンス素子、１０４～１０６：コンデンサ

【特許請求の範囲】
【請求項１】内部に導体パターンで形成された受動素子を有する多層基板を用いた高周波部品であって、
前記高周波部品の一方の表面に外部接続電極を有すると共に、
前記高周波部品の外部接続電極が設けられた面の反対側となる面近傍でかつ高周波部品の内部に接地電極を設けたことを特徴とする高周波部品。
【請求項２】請求項１において、前記多層基板内の受動素子により、フィルタ、カプラ、フェイズシフタのいずれかの機能またはこれらを複合した機能を持たせたことを特徴とする高周波部品。
【請求項３】請求項１または２において、
多層基板内の受動素子のうち、コンデンサは、前記高周波部品を構成する多層基板の積層方向で前記接地電極がある側に偏在させ、かつ前記接地電極をコンデンサ電極の一部として用いたことを特徴とする高周波部品。
【請求項４】請求項１から３までのいずれかにおいて、多層基板内の受動素子のうち、インダクタンス素子は、多層基板の積層方向で前記外部接続電極が形成される側に偏在させて設けたことを特徴とする高周波部品。
【請求項５】請求項４において、
前記外部接続電極を形成する導体パターンは、前記インダクタンス素子を形成するパターンに対し、積層方法での重なりを回避して形成したことを特徴とする高周波部品。
【請求項６】請求項１から５までのいずれかにおいて、前記高周波部品を構成する回路の一部は前記高周波部品の側面に設けた外部接続電極により構成し、
該側面に設けた外部接続電極は、前記表面に設けた外部接続電極に電気的に接続したことを特徴とする高周波部品。
【請求項７】請求項１から６までのいずれかにおいて、高周波部品の表面の外部接続電極上に半田バンプを形成したことを特徴とする高周波部品。
【請求項８】請求項１の高周波部品を製造する方法であって、
前記高周波部品の接地電極が形成された層が前記多層基板の積層方法で前記接地電極が露出しない一方の最外層となり、かつ、前記高周波部品の外部接続電極が形成された層が前記多層基板の積層方法で前記外部接続電極が露出する他方の最外層となるように導体と基板材料とを積層することを特徴とする高周波部品の製造方法。
【請求項９】請求項６の高周波部品を製造する方法であって、
前記高周波部品の側面に設けた外部接続電極と、表面に設けた外部接続電極とを、同一工程でメッキ処理することを特徴とする高周波部品の製造方法。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、携帯電話、自動車電話等の無線機器、あるいはその他の各種通信機器等の分野において使用される表面実装型の高周波部品とその製造方法に係り、特に電磁気的なシールド構造を有し、かつ小型化並びに小面積実装が可能な高周波部品とその製造方法に関する。
【０００２】
【従来の技術】従来の表面実装型高周波部品のうち、小型化を図ったものとして、特開平５－２５９７０３号や、特開平７－３３６１７６号等がある。これらは面実装可能なローパスフィルタの構造について開示しており、ストリップラインを多層基板内に形成すると共に、シールド機能を持たせた構造である。
【０００３】これらの高周波部品は、基本的に図６（Ａ）の外観図と、図６のＸ－Ｘ断面図である図６（Ｂ）によって表現される。図６（Ａ）、（Ｂ）においては、ストリップラインの代わりに旋回パターンを使ったコイルパターンを用いて構成された高周波部品として説明する。図６（Ａ）、（Ｂ）において、１は多層基板でなる高周波部品、２は高周波部品１の側面に設けた外部接続電極、３は高周波部品の積層方向の一方の側に設けた接地電極、６は積層方向の他方の側に設けた接地電極、４はコイル部、５はコンデンサ部であり、該コイル部４とコンデンサ部５はそれぞれこれらの接地電極３、６の間にスペース層（層内の殆どの領域に導体が設けられていない層）７、８を介在させて設けられる。
【０００４】この高周波部品１は、上下に接地電極３、６を設けることにより、外部からの電磁気的な影響を防ぐシールド構造を実現している。また、コンデンサ部５は、接地電極６の導体パターンをコンデンサの接地する側の電極として利用している。一方、コイル部４は、高周波部品１の積層方向の下側のコンデンサ部５と、上側の接地電極３との間にスペース層７、８を介在させることにより、コイル部４のＱが低下しない構造としている。
【０００５】このように高周波部品１は構成されており、携帯電話等の高周波回路内で使用される際、高周波回路内での磁気的な環境の変化に影響されることなく、動作させることが可能となる。
【０００６】
【発明が解決しようとする課題】しかしながら、上記した従来の高周波部品には次のような課題があった。まず、高周波部品１は積層方向で上下双方の最外層付近に接地電極３、６が形成されているが、高周波部品１の内、コイル部４についてはコイルのＱが低下しないようにするために、コイル部４が形成される層の両側に十分なスペース層７、８を形成する必要がある。
【０００７】一般にコイルの場合、コイルを形成する旋回導体パターンを積層方向で上側ないし下側から覆う形で導体パターンを形成するとコイルの有するインダクタ

ンス値が変化する。そのため、インダクタンスの低下分を補うために、前記コイルを形成する旋回導体パターンの径を大きくするか、あるいは旋回数を増やす必要があり、このことはすなわち、旋回する導体の長さを長くすることにつながる。

【０００８】しかしながら、前記コイルの長さを長くすることは、前記コイルの有する実抵抗値が増大することにつながり、それ故前記コイルのＱは低下する。前記Ｑの低下は高周波部品１の例えば挿入損失等の電気特性を悪化させる原因となる。

【０００９】従って、前記スペース層７、８は厚めに設計する必要があり、このことが従来の高周波部品１の薄型化を困難にしていた。

【００１０】さらに、スペース層７、８により高周波部品１の厚みが大きくなることにより、その厚みが高周波部品１の縦横の寸法の内の一方の寸法とほぼ同等ないしは厚みの方が大きくなる可能性がでてくる。このように、部品１の厚みが縦横の寸法の内の一方の寸法と同等ないしは厚みの方が大きくなると、部品１がマザーボードに搭載される際、マウンターによるマザーボードへのマウント時の衝撃で部品１が転倒しやすくなる。すなわち、搭載部品としての実装安定性が低下する。このため、製造現場において、部品実装工程でマウンターにより部品の搭載を行った後に手作業による半田付け後の手直しが必要となり、量産効率が低下する。このような理由から、量産効率を低下させずにすむためには、部品１の厚みに対して部品１の縦横の寸法を小さくすることはできず、厚みの限界が小型化の限界を意味していた。

【００１１】一方、近年においては、チップサイズ実装対応のチップ部品の要求が出てきている。従来の表面実装対応のチップ部品は、チップ部品の側面に形成された電極によりマザーボード上の電極と半田接続される。このため、前記半田接続では半田のフィレット（チップ部品の側面電極からマザーボード上の電極との間にできる半田のせり上がり）が生じる。従って、従来のチップ部品をマザーボードに搭載する際には、前記半田のフィレットのための面積（通常１個のチップ部品に複数箇所必要）と前記チップ部品を搭載する側から見た大きさの面積の双方が前記チップ部品搭載のために実装面積として設計する必要があった。

【００１２】なお、図６（Ｂ）に示すように、側面の外部接続電極２の一部が高周波部品１上面および底面に入り込む部分２ａを利用してチップサイズ実装を行うこともできなくはないが、この入り込んだ部分２ａは電極形状が小さい上に、側面の外部接続電極２に付加的にできるものであるため、その形状自体も不安定になりやすい。また、入り込んだ部分２ａはその電極形状が小さいため、高周波部品１をマザーボードに実装した際、高周波部品１はマザーボードに対して十分な固着強度を得ることができない。

【００１３】本発明は、上記問題点に鑑み、高周波部品の小型化に際し、前記高周波部品の縦横寸法の内の短い方の寸法が同等になるかあるいは超えることを回避し、これにより高周波部品の実装の安定性を確保すると共に、部品外部からの電磁気的影響を受けないシールド構造を有し、さらに小面積実装、すなわちチップサイズ実装を可能とした構造の高周波部品およびその製造方法を提供することを目的とする。

【００１４】

【課題を解決するための手段】この目的を達成するため、本発明の高周波部品は、内部に導体パターンで形成された受動素子を有する多層基板を用いた高周波部品であって、前記高周波部品の一方の表面に外部接続電極を有すると共に、前記高周波部品の外部接続電極が設けられた面の反対側となる面近傍でかつ高周波部品の内部に接地電極を設けたことを特徴とする（請求項１）。

【００１５】また、本発明の高周波部品は、前記多層基板内の受動素子により、フィルタ、カプラ、フェイズシフタのいずれかの機能またはこれらを複合した機能を持たせたことを特徴とする高（請求項２）。

【００１６】また、本発明の高周波部品は、多層基板内の受動素子のうち、コンデンサは、前記高周波部品を構成する多層基板の積層方向で前記接地電極がある側に偏在させ、かつ前記接地電極をコンデンサ電極の一部として用いたことを特徴とする（請求項３）。

【００１７】また、本発明の高周波部品は、多層基板内の受動素子のうち、インダクタンス素子は、多層基板の積層方向で前記外部接続電極が形成される側に偏在させて設けたことを特徴とする（請求項４）。

【００１８】また、本発明の高周波部品は、前記外部接続電極を形成する導体パターンは、前記インダクタンス素子を形成するパターンに対し、積層方法での重なりを回避して形成したことを特徴とする（請求項５）。

【００１９】また、本発明の高周波部品は、前記高周波部品を構成する回路の一部は前記高周波部品の側面に設けた外部接続電極により構成し、該側面に設けた外部接続電極は、前記表面に設けた外部接続電極に電気的に接続したことを特徴とする（請求項６）。

【００２０】また、本発明の高周波部品は、高周波部品の表面の外部接続電極上に半田バンプを形成したことを特徴とする（請求項７）。

【００２１】本発明による高周波部品の製造方法は、請求項１の高周波部品を製造する方法であって、前記高周波部品の接地電極が形成された層が前記多層基板の積層方法で前記接地電極が露出しない一方の最外層となり、かつ、前記高周波部品の外部接続電極が形成された層が前記多層基板の積層方法で前記外部接続電極が露出する他方の最外層となるように導体と基板材料とを積層することを特徴とする（請求項８）。

【００２２】本発明による高周波部品の製造方法は、請

求項６の高周波部品を製造する方法であって、前記高周波部品の側面に設けた外部接続電極と、表面に設けた外部接続電極とを、同一工程でメッキ処理することを特徴とする（請求項９）。

【００２３】

【作用】本発明の電子部品は、多層基板の一方の表面に設けた外部接続電極をマザーボード上の電極に接続し、接地電極を設ける側を上にして実装する。ここで、近年の高周波回路部においては、搭載部品が小型化して来ているため、マザーボードの部品実装面における搭載部品の下に電極パターンを通すことは殆ど行われなくなって来ており、そのため、マザーボード側から搭載部品が直接電磁気的影響を受けるといったことは殆どなくなる。

【００２４】このような状況により、本発明の高周波部品のように、マザーボードに搭載した場合に上側となる側にのみ接地電極を設けたシールド構造をとっても、従来のように、上下両側に接地電極を設けた場合と同等なシールド機能を発揮することが可能である。

【００２５】また、本発明の高周波部品は外部接続電極を設けた一方の表面には接地電極を設けていないため、外部接続電極側を設けた側にコイル部を設ければ、コイル部はコンデンサ部とのみ十分な距離を確保すれば良いことになる。このことにより、コイル部の上下層に十分がスペースを確保していた構成に比べると、極めて薄型化した設計が可能となる。

【００２６】以上により、高周波部品の厚みを薄型化し、かつコイル部のコイルのＱの低下を回避することが可能となることにより、さらなる高周波部品の形状の小型化が可能となる。

【００２７】さらに、マザーボードに高周波部品を実装した状態においては、外部接続電極が高周波部品の底面部に安定して設けられるため、前記したチップサイズ実装に対応することが可能となる。

【００２８】一方、本発明による高周波部品の製造方法においては、シート法による場合、多層基板を構成する各シート上に電極パターンを形成した後、これらのシートを積層成形して多層基板を得るが、外部接続電極が形成される面が積層時に多層基板上に露出する側となり、接地電極が多層基板上に露出しない側となるように各層をシートを積層することにより、外部接続電極と、接地電極の保護層とが積層と同時に形成されるので、積層後にこれらを改めて形成する必要がない。

【００２９】

【発明の実施の形態】図１（Ａ）は本発明による高周波部品の一実施例を示す外観図である図３（Ａ）のＹ－Ｙ断面図、図１（Ｂ）はその等価回路図、図２は本実施例の高周波部品の積層構造を示す斜視図である。図１～図３において、高周波部品１０は、シート法あるいはスクリーン印刷法によりセラミックや樹脂からなる基板材料と導体とを積層してなる多層基板１１からなり、該多層基板１１の一方の表面に外部接続電極１５－１～１５－４を有し、かつ、多層基板１１の外部接続電極１５－１～１５－４が設けられた面の反対側となる面近傍でかつ高周波部品１０の内部に接地電極１２を設けてなる。

【００３０】本実施例の発明の高周波部品は、多層基板内に、コンデンサ部１３を、前記高周波部品を構成する多層基板１１の積層方向で接地電極１２がある側に偏在させ、かつ接地電極１２をコンデンサ電極の一部として設けている。

【００３１】また、コイル部１４からなるインダクタンス素子は、多層基板１１の積層方向で外部接続電極１５－１～１５－４が形成される側に偏在させて設けている。コンデンサ部１３とコイル部１４との間には、導体層を含まないスペース層１６を介在させる。

【００３２】外部接続電極１５－１～１５－４を形成する導体パターンは、インダクタンス素子を形成するコイル部１４の導体パターンに対し、積層方向に見てΔＬで示す間隔を有することにより、積層方法での重なりを回避して形成している。

【００３３】本実施例の高周波部品は、図１（Ｂ）に示すように、コイル部１４により構成されるインダクタンス素子１０３と、コンデンサ部１３に形成されるコンデンサ１０４、１０５、１０６とによりローパスフィルタを構成するものについて示す。端子１０１、１０２は多層基板１１上に複数個形成される外部接続電極１５－１、１５－２として構成される。

【００３４】図３の積層構造をシート法により実現する場合について説明する。前記多層基板１１は各層を構成するシート２０－１～２０－９により構成され、最上部のシート２０－１上には、外部接続電極１５－１～１５－４がそれぞれシート２０－１の端部に露出する形で形成されている。外部接続電極１５－１～１５－４の内、１５－１、１５－２は図１（Ｂ）に示した入出力端子１０１、１０２となり、１５－３、１５－４は接地端子となる。

【００３５】シート２０－２～２０－４上にはコイル部１４が以下に説明するようにヘリカル形状に構成されている。すなわち、本実施例においては、コイル１０３はシート２０－２～２０－４上のコ字形の電極２２、２４、２６により形成されており、コ字形の電極２２の一端は、シート２０－２の端部３５に露出し、他端はシート２０－２を貫通するスルーホール電極２３に接続する。該スルーホール電極２３は、次層のシート２０－３上のコ字形の電極２４の一端に接続し、該電極２４の他端は、シート２０－３を貫通するスルーホール電極２５を介して、次層のシート２０－４上のコ字形電極２６の一端に接続する。該コ字形電極２６の他端３６は、シート２０－４の端部に露出させる。

【００３６】次層のシート２０－５およびその次層のシート２０－６には電極パターンは形成されておらず、上

記したシート２０－２～２０－４に形成されたコイル１０３のQの低下を防ぐためのスペース層１６を構成する。

【００３７】シート２０－７～２０－９上にはコンデンサ１０４、１０５、１０６が以下に説明するように構成されている。最下層のシート２０－９上にはその略全面を覆う接地電極１２が形成され、その上のシート２０－８上には該シート２０－８を誘電体層として前記接地電極１２と対向する電極２８、２９が形成され、これらの電極２８、２９が接地電極１２に対向することにより、それぞれコンデンサ１０５、１０６が構成される。

【００３８】さらに、前記電極２８、２９はその上のシート２０－７上に形成された電極２７に、該シート２０－７を誘電体層としてそれぞれ対向し、コンデンサ１０４を構成する。この場合、コンデンサ１０４の容量は、前記電極２８と２７により構成されるコンデンサと、前記電極２９と２７とにより構成されるコンデンサとの合成容量となる。前記接地電極１２は、シート２０－９上の引き出し電極３３、３４によりシート２０－９の端部に露出させている。また、電極２８、２９はシート２０－８上の引き出し電極３０、３１によりシート２０－８の端部に露出させている。

【００３９】上記した各シート２０－１～２０－９を積層して多層基板１１となる。前記多層基板１１の各シート２０－１～２０－９で端部まで導出された部分を多層基板の１１の側面部で導通を得るために、図３（Ａ）の外観図にも示すように、側面にも電極４１～４４を設け、該側面電極４１～４４を高周波回路の一部（接続回路）として構成する。

【００４０】側面電極４１は、前記外部接続電極１５－１と、コイル部１４の電極２２の一端３５と、コンデンサ電極２８の引き出し電極３０とを接続する。側面電極４２は、外部接続電極１５－２と、コイル部１４の電極２６の一端３６と、コンデンサ電極２９の引き出し電極３１とを接続する。側面電極４３は、外部接続電極１５－３と、接地電極１２の引き出し電極３４とを接続する。側面電極４４は、外部接続電極１５－４と、接地電極１２の引き出し電極３３とを接続する。

【００４１】このように構成した高周波部品１０は、図３（Ｂ）に示すように、外部接続電極１５－１～１５－４をマザーボード６０側（下側）にし、接地電極１２側をマザーボード６０の反対側（上側）にして、マザーボード６０上の電極６１、６３に、外部接続電極１５－３、１５－４を半田６２、６４により接続し、かつ高周波部品１１をマザーボード６０に固定する。外部接続電極１５－１、１５－２も同様にマザーボード６０上の別の電極に固定する。

【００４２】このように、表面に形成した外部接続電極１５－１～１５－４をマザーボード６０に半田等で固定することにより、図３（Ｂ）から理解されるように、搭載部品の面積で実装可能なチップサイズ実装が実現される。

【００４３】さらに、チップサイズ実装を良好に行わせるために、図３（Ａ）に６５で示すように、外部接続電極１５－１～１５－４の表面に半田バンプ（盛り上り状の半田）を付着させることが可能である。半田バンプ６５を設けてくことにより、実装が容易となる。尚、前記半田バンプの形成方法としては、半田マスクによりペースト半田を外部接続電極１５－１～１５－４に印刷し、半田リフロー炉を通過させて形成することが可能である。また、蒸着法を用いて半田を外部接続電極１５－１～１５－４に付着させ、その後半田リフロー炉を通過させて形成することも可能である。

【００４４】次に上記高周波部品１０の好ましい製造方法について説明する。本発明による高周波部品１０を製造する場合、厚膜形成技術を用いたセラミック多層基板１１を使用することが好ましい。すなわち、前記した各シート２０－１～２０－９にセラミックシートを用い、該電極パターンは導体ペーストを厚膜印刷等で形成することが好ましい。

【００４５】この場合、本発明に係る高周波部品の製造方法においては、前記したシート面と形成する導体の関係およびシートの積層方向については上述した実施例の構造と同一の関係とすることが好ましい。すなわち、高周波部品１０を構成する多層基板１１の各層２０－１～２０－９のセラミックグリーンシートにそれぞれ厚膜電極パターンを形成した面を上にして積層し、その際、外部接続電極１５－１～１５－４が形成される面が積層時に多層基板１１上に露出する側となり、接地電極１２が多層基板１１上に露出しない側になるようにする。そして、前記各シートは熱プレスにより積層一体化され、脱バインダーを行い、焼成炉においてセラミックと導体を同時に焼成することが好ましい。これにより、焼成後に別の外部接続電極を形成したり接地電極１２の保護層１７を形成する必要がなくなる。

【００４６】しかしながら、この状態では多層基板１１に形成されている外部接続電極１５－１～１５－４は半田が付着しにくい。これは、多層基板１１の素地であるセラミックと外部接続電極１５－１～１５－４との接着強度を向上させるために、前記外部接続電極１５－１～１５－４を形成するための導体ペースト中にガラスフリットが入っているためである。さらに、上述したように、導体とセラミックとを同時焼成する場合には、それぞれの材料の焼成時の収縮度合いを合わせるためにも前記ガラスフリットが必要となる。そのため、焼成後の多層基板１１の外部接続電極１５－１～１５－４の表面はガラスと導体とが入り混じった状態となり、半田が付着しにくい状態となる。このため、このような導体表面に対してメッキを行って半田付け性を改善させている。

【００４７】本発明の高周波部品の製造方法においても

前述のごとく多層基板１１の外部接続電極１５－１～１５－４に対して半田付け性を改善するためのメッキを行うが、そのメッキ作業は側面電極４１～４４を形成した後に側面電極４１～４４も含めて行う。なお、側面電極４１～４４形成については、導体ペーストを付着後、焼成焼き付けによって形成してもよく、また、蒸着やスパッタリングにより形成してもよい。また、高周波部品１０の特性に問題がなければ樹脂系導体を側面電極４１～４４に用いてもよい。

【００４８】このような側面電極４１～４４を設けることにより、底部のみの電極１５－１～１５－４のみの電極による半田付けによるチップサイズ実装方法のみならず、従来より行われている側面電極による半田付け実装方法となる表面実装にも対応することが可能となり、適用範囲を拡げることができる。

【００４９】外部接続電極１５－１～１５－４や側面電極４１～４４のメッキ処理については、湿式のみならず、蒸着やスパッタリングのような乾式メッキを行ってもよい。湿式を用いた場合、電解中で行うバレルメッキが良好である。このメッキ作業は、前記高周波部品１０の側面および底面に設けられた焼結導体の表面状態を良好にする銅メッキを行い、次に半田による電極の溶解を防ぐ（耐半田食われ性）ためのニッケルメッキを行い、さらに半田の付着性を良好にするための錫メッキを行うという順序で行うことが好ましい。

（他の実施例）以上本発明を実施例により説明したが、本発明は次のような実施も可能である。

（１）上記実施例の構造においては、多層基板１１の側面に電極４１～４４を設けて、高周波部品１０の回路の配線の一部を構成したが、図４の積層構造図に示すように、側面電極４１～４４を用いずに、スルーホール電極７０～７３により回路の配線を行うことも可能である。

【００５０】図４において、スルーホール電極７０はシート２０－１～２０－７に連続させて設けたものであり、前記外部接続電極１５－１と、コイル部１４の電極２２の一端と、コンデンサ電極２８とを接続する。スルーホール電極７１はシート２０－１～２０－７に連続させて設けたものであり、外部接続電極１５－２と、コイル部１４の電極２６の一端と、コンデンサ電極２９とを接続する。スルーホール電極７２はシート２０－１～２０－８に連続させて設けたものであり、外部接続電極１５－３と、接地電極１２とを接続する。スルーホール電極７３はシート２０－１～２０－８に連続させて設けたものであり、外部接続電極１５－４と、接地電極１２とを接続する。

【００５１】図５（Ａ）、（Ｂ）はそれぞれ図４の積層構造を有する高周波部品について、外部接続電極１５－１～１５－４を上側、下側にしてそれぞれ示す。

（２）上記実施例においては、ヘリカル型のコイルをローパスフィルタのインダクタンスとして用いているが、前記コイルは同一平面上で渦巻き状に形成されるスパイラル形状であってもよい。また、インダクタンス素子としてマイクロストリップ線路等の線路素子を用いてもよい。この場合、前記線路素子と接地電極との距離が小さくなると線路インピーダンスが小さくなることにより線路素子のＱが低下するため、本発明の構成の如く、接地電極と線路素子であるマイクロストリップラインの距離を十分とれる構成が適している。

（３）上記実施例においては、ローパスフィルタの例をあげて説明したが、本発明は、フィルタ以外に、インダクタンス素子とコンデンサからなるカプラやフェイズシフタとしての機能を発揮するか、あるいはこれらを複合した機能を発揮するものを実現することができる。

（４）上記実施例においては、セラミックグリーンシートに導体ペーストを使って印刷法により導体パターンを形成し、それらを積層するシート積層法で高周波部品を製造しているが、誘電体部分となるセラミックも塗料化して、全て印刷法によって積層する印刷積層法を用いても本発明に係る高周波部品の製造は可能である。

【００５２】

【発明の効果】請求項１によれば、高周波部品の一方の表面に外部接続電極を有すると共に、前記高周波部品の外部接続電極が設けられた面の反対側となる面の近傍でかつ高周波部品の内部に接地電極を設けたので、部品の小型化により部品の下に導体パターンを設けない近年の状況においては、従来のシールド構造と同等のシールド効果が得られる。また、外部接続電極を設けた側には接地電極を設けないことにより、部品形状の小型化が可能で、チップサイズ実装が可能な高周波部品が提供できる。

【００５３】請求項２によれば、前記多層基板内の受動素子により、フィルタ、カプラ、フェイズシフタのいずれかの機能またはこれらを複合した機能を持たせたものであり、これらの小型化、チップサイズ実装が可能となる。

【００５４】請求項３によれば、多層基板内の受動素子のうち、コンデンサは、前記高周波部品を構成する多層基板の積層方向で接地電極がある側に偏在させ、かつ接地電極をコンデンサの一部として設けたので、多層基板内のスペースにおけるパターンの利用効率が向上し、部品のさらなる小型化が可能となる。

【００５５】請求項４によれば、多層基板内の受動素子のうち、インダクタンス素子は、多層基板の積層方向で接地電極のない外部接続電極が形成される側に偏在させて設けたので、接地電極までの距離を十分確保できるため、インダクタンス素子のＱの低下を防ぎ、高周波部品の良好な特性を発現できる。

【００５６】請求項５によれば、前記外部接続電極を形成する導体パターンを、前記インダクタンス素子を形成するパターンに対し、積層方法での重なりを回避して形

成したので、インダクタンス素子のQの低下を防止することができる。

【００５７】請求項６によれば、前記高周波部品を構成する回路の一部は前記高周波部品の側面に設けた外部接続電極により構成し、該側面に設けた外部接続電極は、前記表面に設けた外部接続電極に電気的に接続したので、高周波部品を従来の表面実装部品として兼用することができる。また、従来の高周波部品として用いた場合、本発明の高周波部品は部品の底面側に外部接続電極が新たに形成されている分、部品のマザーボードに対する固着強度が増大する。

【００５８】請求項７によれば、高周波部品の表面の外部接続電極上に半田バンプを形成したので、高周波部品のマザーボードへの半田付けが容易となる。

【００５９】請求項８によれば、高周波部品の接地電極が形成された層が前記多層基板の積層方法で前記接地電極が露出しない一方の最外層となり、かつ、前記高周波部品の外部接続電極が形成された層が前記多層基板の積層方法で前記外部接続電極が露出する他方の最外層となるように導体と基体材料とを積層することにより、高周波部品を製造するため、電極パターンは積層前の個々のグリーンシート等の基板材料層に対して形成するだけでよく、積層後に改めて電極パターンを高周波部品の積層方向の面に形成する必要がない。また、高周波部品のシールド電極となる接地電極には外部に対する保護層も同時に形成され、積層後に保護層を設ける必要がなく、工程数が少なくてすむ。

【００６０】請求項９によれば、前記高周波部品の側面に設けた外部接続電極と、表面に設けた外部接続電極とを、同一工程でメッキ処理するため、従来の表面実装部品としても使用可能な側面電極にすることができ、メッキ工程数も増えることがない。

【図面の簡単な説明】

【図１】（Ａ）は本発明による高周波部品の一実施例を示す図３（Ａ）のＹ－Ｙ断面図、（Ｂ）は本発明の高周波部品により実現される回路の一例であるローパスフィルタを示す等価回路図である。

【図２】本発明の高周波部品の一実施例を示す積層構造図である。

【図３】（Ａ）は本実施例の外観図、（Ｂ）は（Ａ）のＹ－Ｙ線に沿って示すマザーボードへの実装断面図である。

【図４】本発明の高周波部品の他の実施例を示す積層構造図である。

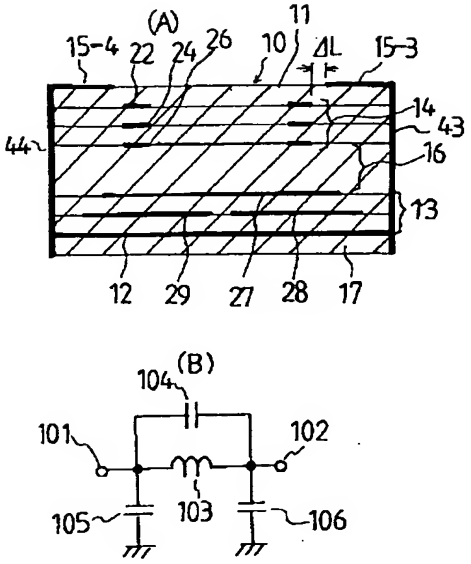
【図５】（Ａ）、（Ｂ）はそれぞれ図４の実施例において、外部接続電極を上、下にして示す外観図である。

【図６】（Ａ）は従来の高周波部品の外観図、（Ｂ）は（Ａ）のＸ－Ｘ断面図である。

【符号の説明】

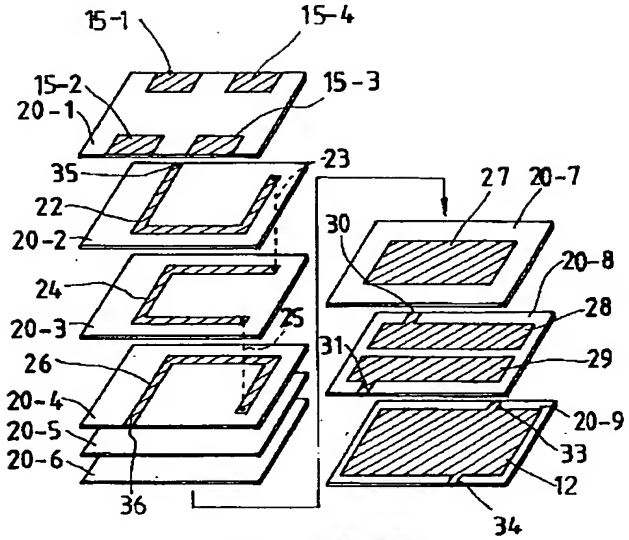
１０：高周波部品、１１：多層基板、１２：接地電極、１３：コンデンサ部、１４：コイル部、１５－１～１５－４：外部接続電極、１６：スペース層、２０－１～２０－９：シート、２２、２４、２６：コイルの電極、２３、２５：スルーホール電極、２７～２９：コンデンサ電極、４１～４４：側面電極、６０：マザーボード、６１、６３：電極、６２、６４：半田、７０～７３：スルーホール電極、１０１、１０２：端子、１０３：インダクタンス素子、１０４～１０６：コンデンサ

【図１】



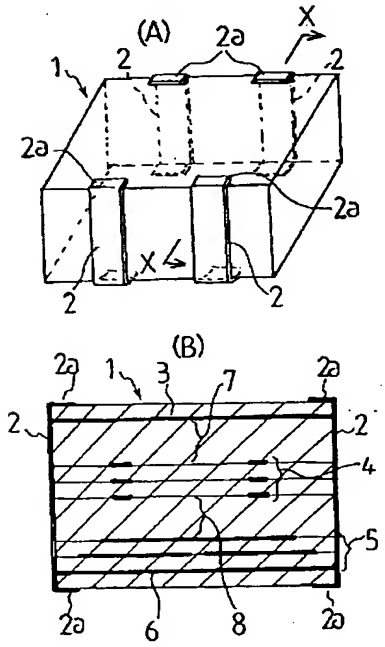
１０：高周波部品、１１：多層基板、１２：接地電極
１３：コンデンサ部、１４：コイル部
１５－３、１５－４：外部接続電極
１６：スペース層、２２、２４、２６：コイルの電極
２７～２９：コンデンサ電極、１０１、１０２：端子
１０３：インダクタンス素子、１０４～１０６：コンデンサ

【図２】

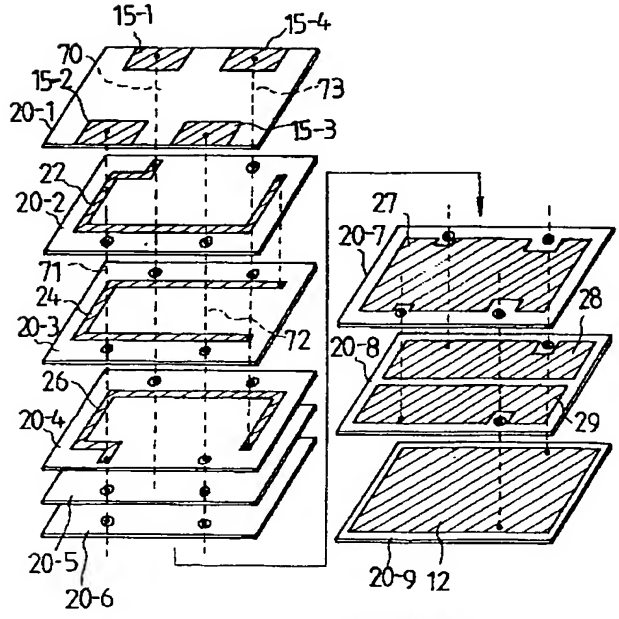


１５－１～１５－４：外部接続電極
２０－１～２０－９：シート
２２、２４、２６：コイルの電極
２３、２５：スルーホール電極
２７～２９：コンデンサ電極

【図６】

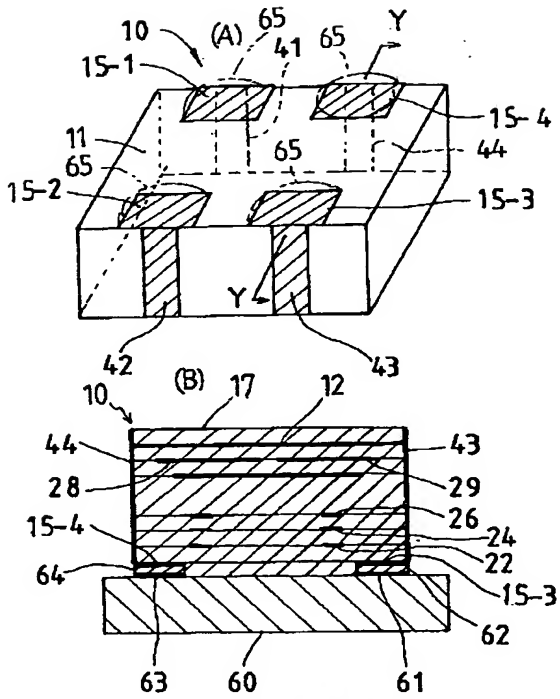


【図４】



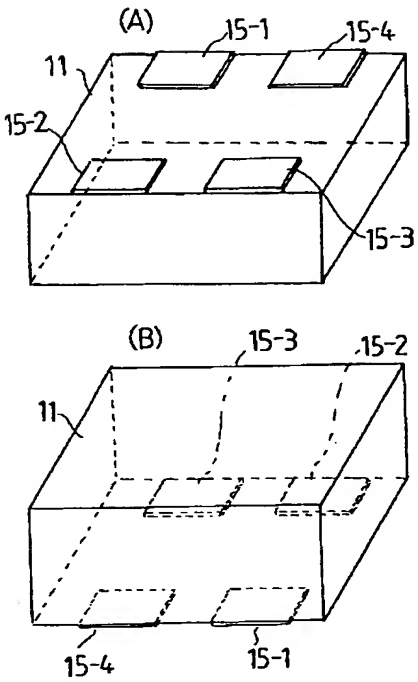
１５－１～１５－４：外部接続電極
２０－１～２０－９：シート
２２、２４、２６：コイルの電極
２３、２５：スルーホール電極
２７～２９：コンデンサ電極
７０～７３：スルーホール電極

【図３】



１０：高周波部品、１１：多層基板
１２：接地電極、１３：コンデンサ部
１４：コイル部、１５－１～１５－４：外部接続電極
２２、２４、２６：コイルの電極
２７～２９：コンデンサ電極
４１～４４：側面電極、
６０：マザーボード、６１、６３：電極
６２、６４：半田

【図５】



１１：多層基板
１５－１～１５－４：外部接続電極

フロントページの続き

(51) Int. Cl. ⁶		識別記号	F I		
	Ｈ０１Ｆ	41/06	Ｈ０１Ｆ	15/00	Ｄ
	Ｈ０１Ｇ	4/40		15/04	
//	Ｈ０３Ｈ	3/007	Ｈ０１Ｇ	4/40	３２１Ａ

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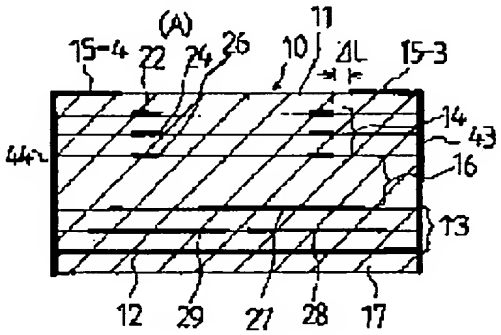
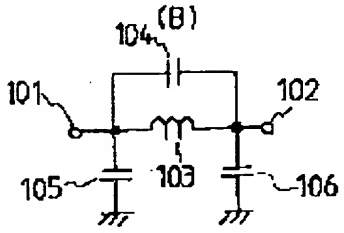
(22)Date of filing : 26.09.1997

(71)Applicant : TDK CORP
(72)Inventor : HAYASHI KATSUHIKO

(54) HIGH FREQUENCY COMPONENT AND ITS PRODUCTION

(57)Abstract:
PROBLEM TO BE SOLVED: To secure stability in mounting by miniaturizing a high frequency component and preventing the shorter dimension of the longitudinal and lateral dimensions of the high frequency component from getting equal or longer by providing an external connecting electrode on one surface of the high frequency component and providing a ground electrode inside the high frequency component near the surface of the high frequency component opposed to the surface where the external connecting electrode is provided.
SOLUTION: A high frequency component 10 is composed of a multilayer substrate 11 constituted by laminating a substrate material composed of ceramic or resin and a conductor through sheeting or screen printing. External connecting electrodes 15-3 to 15-4 are provided on one surface of the multilayer substrate 11 and a ground electrode 12 is provided inside the high frequency component 10 near the surface of the multilayer substrate 11 opposed to the surface where the external connecting electrodes 15-3 to 15-4 are provided. Concerning the high frequency component 10, a capacitor part 13 exists inside the multilayer substrate 11 eccentrically to the side of the ground electrode 12 in the laminating direction of the multilayer substrate 11 consisting of the high frequency component 10, and the ground electrode 12 is provided as one part of a capacitor electrode.





LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or

application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

* NOTICES *

1. This document has been translated by computer.So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] The radio-frequency-head article which is near [which is a radio-frequency-head article using the multilayer substrate which has the passive element formed in the interior by the conductor pattern, and serves as an opposite side of the field in which the external connection electrode of the aforementioned radio-frequency-head article was prepared while having an external connection electrode on one front face of the aforementioned radio-frequency-head article] the field, and is characterized by preparing a grounding electrode in the interior of a radio-frequency-head article.
[Claim 2] The radio-frequency-head article characterized by giving the function which compounded the function of a filter, a coupler, or a phase shifter, or these by the passive element in the aforementioned multilayer substrate in a claim 1.
[Claim 3] It is the radio-frequency-head article characterized by having made the capacitor unevenly distributed in the side which has the aforementioned grounding electrode in the direction of a laminating of the multilayer substrate which constitutes the aforementioned radio-frequency-head article, and using the aforementioned grounding electrode as a part of capacitor electrode among the passive elements in a multilayer substrate in claims 1 or 2.
[Claim 4] It is the radio-frequency-head article characterized by having made the inductance element unevenly distributed in the side in which the aforementioned external connection electrode is formed in the direction of a laminating of a multilayer substrate, and preparing it among the passive elements in a multilayer substrate in either to claims 1-3.
[Claim 5] The conductor pattern which forms the aforementioned external connection electrode in a claim 4 is a radio-frequency-head article characterized by avoiding and forming the lap in the laminating method to the pattern which forms the aforementioned inductance element.
[Claim 6] The external connection electrode which constituted a part of circuit which constitutes the aforementioned radio-frequency-head article in either to claims 1-5 by the external connection electrode prepared in the side of the aforementioned radio-frequency-head article, and was prepared in this side is a radio-frequency-head article characterized by connecting with the external connection electrode prepared in the aforementioned front face electrically.
[Claim 7] The radio-frequency-head article characterized by forming a solder bump on the external connection electrode of the front face of a radio-frequency-head article in either to claims 1-6.
[Claim 8] Are the method of manufacturing the radio-frequency-head article of a claim 1, and by the laminating method of the aforementioned multilayer substrate, while is not exposed and the aforementioned grounding electrode serves as [the layer in which the grounding electrode of the aforementioned radio-frequency-head article was formed] an outermost layer of drum. And the manufacture method of the radio-frequency-head article characterized by carrying out the laminating of a conductor and the substrate material so that the layer in which the external connection electrode of the aforementioned radio-frequency-head article was formed may turn into an outermost layer of drum of another side which the aforementioned external connection electrode exposes by the laminating method of the aforementioned multilayer substrate.
[Claim 9] The manufacture method of the radio-frequency-head article characterized by carrying

out plating processing of the external connection electrode which is the method of manufacturing the radio-frequency-head article of a claim 6, and was prepared in the side of the aforementioned radio-frequency-head article, and the external connection electrode prepared in the front face at the same process.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] the radio-frequency-head article which is the surface mount type with which this invention is used in fields, such as walkie-talkie machines, such as a cellular phone and a car telephone, or other various communication equipment, and its manufacture method -- starting -- especially, electromagnetism shield structure -- having -- and a miniaturization and a facet -- it is related with the radio-frequency-head article in which product mounting is possible, and its manufacture method
[0002]
[Description of the Prior Art] There are JP,5-259703,A, JP,7-336176,A, etc. as what attained the miniaturization among the conventional surface mount type radio-frequency-head articles. These are the structures which gave the shield function while they are indicating about the structure of the low pass filter in which surface mounting is possible and form a stripline in a multilayer substrate.
[0003] Such radio-frequency-head articles are expressed by drawing 6 (B) which is the external view of drawing 6 (A), and the X-X cross section of drawing 6 fundamentally. In drawing 6 (A) and (B), it explains as a radio-frequency-head article constituted using the coil pattern using the revolution pattern instead of the stripline. The radio-frequency-head article with which 1 becomes by the multilayer substrate in drawing 6 (A) and (B), the external connection electrode which prepared 2 in the side of the radio-frequency-head article 1, The grounding electrode which prepared 3 in one direction side of a laminating of a radio-frequency-head article, the grounding electrode which prepared 6 in the another side side of the direction of a laminating, 4 is the coil section, 5 is the capacitor section, and among these grounding electrodes 3 and 6, this coil section 4 and the capacitor section 5 make the space layers (layer in which the conductor is not prepared in almost all the fields in a layer) 7 and 8 intervene, and are prepared, respectively.
[0004] This radio-frequency-head article 1 has realized shield structure which prevents the electromagnetism-influence from the outside by forming grounding electrodes 3 and 6 up and down. Moreover, the capacitor section 5 is used as an electrode of the side to which a capacitor grounds the conductor pattern of a grounding electrode 6. On the other hand, the coil section 4 is taken as the structure where Q of the coil section 4 does not fall, by making the space layers 7 and 8 intervene between the capacitor section 5 of the direction bottom of a laminating of the radio-frequency-head article 1, and the upper grounding electrode 3.
[0005] Thus, the radio-frequency-head article 1 is constituted, and it becomes possible to make it operate, without being influenced by change of the magnetic environment in a RF circuit in case it is used in RF circuits, such as a cellular phone.
[0006]
[Problem(s) to be Solved by the Invention] However, there were the following technical problems in the above-mentioned conventional radio-frequency-head article. First, although grounding electrodes 3 and 6 are formed near the outermost layer of drum of both upper and lower sides in the direction of a laminating, the radio-frequency-head article 1 needs to form sufficient space layers 7 and 8 for the both sides of a layer in which the coil section 4 is formed, in order to make

it Q of a coil not fall about the coil section 4 among the radio-frequency-head articles 1.
[0007] If the revolution conductor pattern which forms a coil is generally formed in the direction of a laminating in the case of a coil and a conductor pattern is formed with a wrap form from a top or the bottom, the inductance value which a coil has will change. Therefore, in order to compensate a fallen part of an inductance, it leads to enlarging the path of the revolution conductor pattern which forms the aforementioned coil, or it being necessary to increase the number of revolution, and lengthening the length of this, i.e., the conductor which circles.
[0008] However, lengthening the length of the aforementioned coil leads to the real resistance which the aforementioned coil has increasing, and, so, Q of the aforementioned coil falls. The fall of Above Q becomes the cause of worsening electrical properties, such as the radio-frequency-head article 1, for example, an insertion loss etc.
[0009] Therefore, the aforementioned space layers 7 and 8 needed to be designed more thickly, and this made difficult thin shape-ization of the conventional radio-frequency-head article 1.
[0010] Furthermore, by the space layers 7 and 8, the thickness of the radio-frequency-head article 1 is large, and possibility that the direction of an EQC or thickness will become [the thickness] large mostly by the bird clapper with one size of the sizes of the radio-frequency-head article 1 in every direction comes out. Thus, when the direction of one size of the sizes with the thickness of parts 1 in every direction, an EQC, or thickness becomes large, in case parts 1 are carried in a mother board, it becomes easy to reverse parts 1 with the shock at the time of mounting to the mother board by the mounter. That is, the mounting stability as loading parts falls. For this reason, in a manufacture site, after carrying parts with a mounter at a component-mounting process, the repair after soldering by the handicraft is needed, and mass-production efficiency falls. Since it is such, in order not to reduce mass-production efficiency, the size of parts 1 in every direction could not be made small to the thickness of parts 1, but the limitation of thickness meant the limitation of a miniaturization.
[0011] On the other hand, in recent years, the demand of the chip dealing with chip size mounting is coming out. Solder connection of the chip of the conventional surface mount correspondence is made with the electrode on a mother board by the electrode formed in the side of a chip. For this reason, in the aforementioned solder connection, the fillet (the solder made between the electrodes on a mother board from the side electrode of a chip rising) of solder arises. Therefore, when the conventional chip was carried in a mother board, the both sides of the area of a size which saw from the side which carries the area (two or more places are usually required for one chip) and the aforementioned chip for the fillet of the aforementioned solder needed to design as a component-side product for the aforementioned chip loading.
[0012] In addition, since it is that an addition target can do this partial that entered 2a in the top where an electrode configuration is small at the external connection electrode 2 of the side although chip size mounting can also be performed using partial to which a part of external connection electrode 2 of the side enters radio-frequency-head article 1 upper surface and base as shown in drawing 6 (B) 2a and there is nothing that there is nothing, the configuration itself tends to become unstable. Moreover, since the electrode configuration is small, when partial 2a which entered mounts the radio-frequency-head article 1 in a mother board, the radio-frequency-head article 1 cannot obtain sufficient fixing intensity to a mother board.
[0013] or [that, as for this invention, the size of the shorter one of the in-every-direction sizes of the aforementioned radio-frequency-head article becomes equivalent on the occasion of the miniaturization of a radio-frequency-head article in view of the above-mentioned trouble] -- or, while it avoids exceeding and this secures the stability of mounting of a radio-frequency-head article It has the shield structure where it is not electromagnetic-like influenced from the part outside, and aims at offering the radio-frequency-head article and its manufacture method of the structure which enabled small area mounting, i.e., chip size mounting, further.
[0014]
[Means for Solving the Problem] In order to attain this purpose, while the radio-frequency-head article of this invention is a radio-frequency-head article using the multilayer substrate which has the passive element formed in the interior by the conductor pattern and having an external

connection electrode on one front face of the aforementioned radio-frequency-head article, it is near the field used as the opposite side of the field in which the external connection electrode of the aforementioned radio-frequency-head article was prepared, and is characterized by to prepare a grounding electrode in the interior of a radio-frequency-head article (claim 1).
[0015] Moreover, the radio-frequency-head article of this invention is quantity (claim 2) characterized by giving the function which compounded the function of a filter, a coupler, or a phase shifter, or these by the passive element in the aforementioned multilayer substrate.
[0016] Moreover, the radio-frequency-head article of this invention is characterized by for the capacitor having made it unevenly distributed in the side which has the aforementioned grounding electrode in the direction of a laminating of the multilayer substrate which constitutes the aforementioned radio-frequency-head article, and using the aforementioned grounding electrode for it as a part of capacitor electrode among the passive elements in a multilayer substrate (claim 3).
[0017] Moreover, the radio-frequency-head article of this invention is characterized by having made the inductance element unevenly distributed in the side in which the aforementioned external connection electrode is formed, and preparing it in the direction of a laminating of a multilayer substrate, among the passive elements in a multilayer substrate, (claim 4).
[0018] Moreover, the conductor pattern in which the radio-frequency-head article of this invention forms the aforementioned external connection electrode is characterized by avoiding and forming the lap in the laminating method to the pattern which forms the aforementioned inductance element (claim 5).
[0019] Moreover, the external connection electrode prepared in the side of the aforementioned radio-frequency-head article constitutes a part of circuit where the radio-frequency-head article of this invention constitutes the aforementioned radio-frequency-head article, and it is characterized by connecting electrically the external connection electrode prepared in this side to the external connection electrode prepared in the aforementioned front face (claim 6).
[0020] Moreover, it is characterized by the radio-frequency-head article of this invention forming a solder bump on the external connection electrode of the front face of a radio-frequency-head article (claim 7).
[0021] The manufacture method of the radio-frequency-head article by this invention is a method of manufacturing the radio-frequency-head article of a claim 1. By the laminating method of the aforementioned multilayer substrate, while is not exposed and the aforementioned grounding electrode serves as [the layer in which the grounding electrode of the aforementioned radio-frequency-head article was formed] an outermost layer of drum. And it is characterized by carrying out the laminating of a conductor and the substrate material so that the layer in which the external connection electrode of the aforementioned radio-frequency-head article was formed may turn into an outermost layer of drum of another side which the aforementioned external connection electrode exposes by the laminating method of the aforementioned multilayer substrate (claim 8).
[0022] The manufacture method of the radio-frequency-head article by this invention is a method of manufacturing the radio-frequency-head article of a claim 6, and is characterized by carrying out plating processing of the external connection electrode prepared in the side of the aforementioned radio-frequency-head article, and the external connection electrode prepared in the front face at the same process (claim 9).
[0023]
[Function] The electronic parts of this invention connect to the electrode on a mother board the external connection electrode prepared in one front face of a multilayer substrate, and mount by turning up the side which prepares a grounding electrode. Here, in the RF circuit section in recent years, since loading parts are miniaturized, most things for which it lets an electrode pattern pass under the loading parts in the component side of a mother board are no longer performed, therefore most things that loading parts are direct electromagnetism-influenced by the mother board side are lost.
[0024] When carried in a mother board, even if it takes the shield structure which prepared the grounding electrode only in the side used as the bottom like the radio-frequency-head article of

this invention according to such a situation, it is possible to demonstrate a shield function equivalent to the case where a grounding electrode is prepared in vertical both sides, like before.

[0025] Moreover, since the radio-frequency-head article of this invention has not prepared the grounding electrode in a front face, if while prepared the external connection electrode, and it prepares the coil section in the side which prepared the external connection electrode side, it should just secure distance with the as sufficient coil section as the capacitor section. By this, the design of 10 minutes extremely thin-shape-ized compared with the composition which had secured the space is attained at the vertical layer of the coil section.
[0026] It becomes possible [thin-shape-izing thickness of a radio-frequency-head article, and avoiding the fall of Q of the coil of the coil section by the above,] by the bird clapper to miniaturize [of the configuration of the further radio-frequency-head article] possible.
[0027] Furthermore, in the state where the radio-frequency-head article was mounted in the mother board, since an external connection electrode is stabilized and prepared in the base section of a radio-frequency-head article, it becomes possible to correspond to said chip size mounting.
[0028] On the other hand, although laminate molding of these sheets is carried out and a multilayer substrate is obtained in the manufacture method of the radio-frequency-head article by this invention after forming an electrode pattern on each sheet which constitutes a multilayer substrate when based on the sheet method Each class by carrying out the laminating of the sheet so that the field in which an external connection electrode is formed may become the side exposed on a multilayer substrate at the time of a laminating and it may become the side which a grounding electrode does not expose on a multilayer substrate Since an external connection electrode and the protective layer of a grounding electrode are formed simultaneously with a laminating, it is not necessary to form these anew after a laminating.
[0029]
[Embodiments of the Invention] It is the perspective diagram in which the Y-Y cross section of drawing 3 (A) whose drawing 1 (A) is the external view showing one example of the radio-frequency-head article by this invention, and drawing 1 (B) show the representative circuit schematic, and drawing 2 shows the laminated structure of the radio-frequency-head article of this example. The radio-frequency-head article 10 consists of a multilayer substrate 11 which comes to carry out the laminating of the substrate material which consists of a ceramic or a resin with the sheet method or screen printing, and the conductor in drawing 1 - drawing 3 . It is near the field used as the opposite side of the field in which it has the external connection electrode 15-1 to 15-4 on one front face of this multilayer substrate 11, and the external connection electrode 15-1 to 15-4 of the multilayer substrate 11 was formed, and comes to prepare a grounding electrode 12 in the interior of the radio-frequency-head article 10.
[0030] In the multilayer substrate, the radio-frequency-head article of invention of this example made the capacitor section 13 unevenly distributed in the side which has a grounding electrode 12 in the direction of a laminating of the multilayer substrate 11 which constitutes the aforementioned radio-frequency-head article, and has formed the grounding electrode 12 as a part of capacitor electrode.
[0031] Moreover, in the direction of a laminating of the multilayer substrate 11, the inductance element which consists of the coil section 14 was made unevenly distributed in the side in which the external connection electrode 15-1 to 15-4 is formed, and is prepared. The space layer 16 which does not contain a conductor layer is made to intervene between the capacitor section 13 and the coil section 14.
[0032] The conductor pattern which forms the external connection electrode 15-1 to 15-4 avoids and forms the lap in the laminating method by having the interval which looks at in the direction of a laminating and is shown by deltaL to the conductor pattern of the coil section 14 which forms an inductance element.
[0033] The radio-frequency-head article of this example shows what constitutes a low pass filter by the inductance element 103 constituted by the coil section 14 and the capacitors 104, 105, and 106 formed in the capacitor section 13, as shown in drawing 1 (B). Terminals 101 and 102

are constituted as the external connection electrode 15-1 formed on the multilayer substrate 11, and 15-2. [two or more]
[0034] The case where the laminated structure of drawing 3 is realized by the sheet method is explained. The aforementioned multilayer substrate 11 is constituted by the sheet 20-1 to 20-9 which constitutes each class, and is formed on the topmost sheet 20-1 in the form which the external connection electrode 15-1 to 15-4 exposes to the edge of a sheet 20-1, respectively. 15-1 and 15-2 become the input/output terminals 101 and 102 shown in drawing 1 (B) among the external connection electrodes 15-1 to 15-4, and 15-3 and 15-4 become an earth terminal.
[0035] It is constituted by the helical configuration so that the coil section 14 may explain below on sheet 20-2 - 20-4. That is, in this example, the coil 103 is formed of the electrodes 22, 24, and 26 of the KO typeface on sheet 20-2 - 20-4, exposes the end of the electrode 22 of a KO typeface to the edge 35 of a sheet 20-2, and connects the other end to the through hole electrode 23 which penetrates a sheet 20-2. It connects with the end of the electrode 24 of the KO typeface on the sheet 20-3 of the following layer, and this through hole electrode 23 connects the other end of this electrode 24 to the end of the KO typeface electrode 26 on the sheet 20-4 of the following layer through the through hole electrode 25 which penetrates a sheet 20-3. The other end 36 of this KO typeface electrode 26 is exposed at the edge of a sheet 20-4.

[0036] On the sheet 20-5 of the following layer, and the sheet 20-6 of the following layer, an electrode pattern constitutes the space layer 16 for preventing the fall of Q of the coil 103 which was not formed but was formed in the above-mentioned sheet 20-2 to 20-4.
[0037] On sheet 20-7 - 20-9, it is constituted so that capacitors 104, 105, and 106 may explain below. On the sheet 20-9 of the lowest layer, the wrap grounding electrode 12 is formed in the whole abbreviation surface, the aforementioned grounding electrode 12 and the electrodes 28 and 29 which counter are formed by making this sheet 20-8 into a dielectric layer on the sheet 20-8 on it, and when these electrodes 28 and 29 counter a grounding electrode 12, capacitors 105 and 106 are constituted, respectively.
[0038] Furthermore, the aforementioned electrodes 28 and 29 counter the electrode 27 formed on the sheet 20-7 on it considering this sheet 20-7 as a dielectric layer, respectively, and constitute a capacitor 104. In this case, the capacity of a capacitor 104 turns into a synthetic capacity with the capacitor constituted by the capacitor constituted by the aforementioned electrodes 28 and 27 and the aforementioned electrodes 29 and 27. The aforementioned grounding electrode 12 is exposed at the edge of a sheet 20-9 by the drawer electrodes 33 and 34 on a sheet 20-9. Moreover, electrodes 28 and 29 are exposed at the edge of a sheet 20-8 by the drawer electrodes 30 and 31 on a sheet 20-8.
[0039] The laminating of each above-mentioned sheet 20-1 to 20-9 is carried out, and it becomes the multilayer substrate 11. In order to obtain a flow for the portion drawn to the edge with each sheet 20-1 to 20-9 of the aforementioned multilayer substrate 11 by the lateral portion of 11 of a multilayer substrate, as shown also in the external view of drawing 3 (A), electrodes 41-44 are formed also in the side, and these side electrodes 41-44 are constituted as a part of RF circuit (connection circuit).
[0040] The side electrode 41 connects the end 35 of the aforementioned external connection electrode 15-1 and the electrode 22 of the coil section 14, and the drawer electrode 30 of the capacitor electrode 28. The side electrode 42 connects the end 36 of the external connection electrode 15-2 and the electrode 26 of the coil section 14, and the drawer electrode 31 of the capacitor electrode 29. The side electrode 43 connects the external connection electrode 15-3 and the drawer electrode 34 of a grounding electrode 12. The side electrode 44 connects the external connection electrode 15-4 and the drawer electrode 33 of a grounding electrode 12.
[0041] Thus, as shown in drawing 3 (B), the constituted radio-frequency-head article 10 makes the external connection electrode 15-1 to 15-4 a mother board 60 side (below), makes a grounding-electrode 12 side the opposite side (above) of a mother board 60, and connects the external connection electrode 15-3 and 15-4 to the electrodes 61 and 63 on a mother board 60 with solder 62 and 64, and fixes the radio-frequency-head article 11 to a mother board 60. The external connection electrode 15-1 and 15-2 are similarly fixed to another electrode on a mother

board 60.
[0042] Thus, by fixing to a mother board 60 with solder etc. the external connection electrode 15-1 to 15-4 formed in the front face, chip size mounting which can be mounted in the area of loading parts is realized so that I may be understood from drawing 3 (B).
[0043] Furthermore, in order to make chip size mounting perform good, it is possible to make a solder bump (solder of the letter of climax) adhere to the front face of the external connection electrode 15-1 to 15-4 at drawing 3 (A), as shown in 65. The solder bump 65 is formed and mounting becomes easy by Lycium chinense. In addition, it is possible to print paste solder with a solder mask to the external connection electrode 15-1 to 15-4, to pass a solder reflow furnace as the aforementioned solder bump's formation method, and to form. Moreover, it is also possible to make solder adhere to the external connection electrode 15-1 to 15-4 using a vacuum deposition, to pass a rice field reflow furnace the second half, and to form.
[0044] Next, the desirable manufacture method of the above-mentioned radio-frequency-head article 10 is explained. When manufacturing the radio-frequency-head article 10 by this invention, it is desirable to use the ceramic multilayer substrate 11 using thick-film formation technology. namely, each of said sheet 20-1 to 20-9 -- a ceramic sheet -- using -- this electrode pattern -- a conductor -- it is desirable to form a paste by thick film screen printing etc.
[0045] In this case, in the manufacture method of the radio-frequency-head article concerning this invention, it is desirable to consider as the same relation as the structure of the example mentioned above about the relation between said sheet side and the conductor to form, and the direction of a laminating of a sheet. That is, it is made to become the side which turns into a side which the field in which the field which formed the thick-film electrode pattern in the ceramic green sheet of each class 20-1 to 20-9 of the multilayer substrate 11 which constitutes the radio-frequency-head article 10, respectively is turned up, a laminating is carried out, and the external connection electrode 15-1 to 15-4 is formed in that case exposes on the multilayer substrate 11 at the time of a laminating, and a grounding electrode 12 does not expose on the multilayer And as for each aforementioned sheet, it is desirable for laminating unification to be carried out by the heat press, to perform a ** binder, and to calcinate a ceramic and a conductor simultaneously in a firing furnace. It becomes unnecessary to form another external connection electrode after baking by this, or to form the protective layer 17 of a grounding electrode 12.
[0046] However, in this state, as for the external connection electrode 15-1 to 15-4 currently formed in the multilayer substrate 11, solder cannot adhere easily. the conductor for forming the aforementioned external connection electrode 15-1 to 15-4, in order that this may raise the bond strength of the ceramic and the external connection electrode 15-1 to 15-4 which are the base of the multilayer substrate 11 -- it is because the glass frit is contained during the paste Furthermore, as mentioned above, in carrying out simultaneous baking of a conductor and the ceramic, in order to double the contraction degree at the time of baking of each material, the aforementioned glass frit is needed. Therefore, the front face of the external connection electrode 15-1 to 15-4 of the multilayer substrate 11 after baking will be in the state where it was mixed by glass and the conductor, and will be in the state where solder cannot adhere easily. for this reason, such a conductor -- it plates to a front face and soldering nature is made to improve
[0047] Although plating for improving soldering nature to the external connection electrode 15-1 to 15-4 of the multilayer substrate 11 also in the manufacture method of the radio-frequency-head article of this invention like the above-mentioned is performed, after the plating work forms the side electrodes 41-44, it is performed also including the side electrodes 41-44. in addition -- 41 to side electrode 44 formation -- a conductor -- a paste may be formed by baking baking after adhering, and you may form by vacuum evaporationo or sputtering moreover -- if there is no problem in the property of the radio-frequency-head article 10 -- a resin system -- you may use a conductor for the side electrodes 41-44
[0048] By forming such side electrodes 41-44, it becomes possible to correspond not only to the chip size mounting method by soldering by the electrode of only the electrode 15-1 to 15-4 of

only a bottom but to the surface mount used as the soldering mounting method by the side electrode currently performed from before, and a scope can be extended.
[0049] About plating processing of the external connection electrode 15-1 to 15-4, or the side electrodes 41-44, you may perform dry type plating like not only wet but vacuum evaporationo, or sputtering. When wet is used, barrel plating performed by being under electrolysis is good. sintering to which this plating work was prepared in the side and the base of the aforementioned radio-frequency-head article 10 -- it is desirable to carry out in the sequence of performing copper coating which makes the surface state of a conductor good, performing nickel plating for next preventing the dissolution of the electrode by solder (solder-proof foods crack nature), and performing tinning for making adhesion of solder good further
(others -- example) although the example explained this invention above, the following operations are also possible for this invention
(1) In the structure of the above-mentioned example, although electrodes 41-44 were formed in the side of the multilayer substrate 11 and a part of wiring of the circuit of the radio-frequency-head article 10 was constituted, as shown in the laminated-structure view of drawing 4 , it is also possible to wire a circuit by the through hole electrodes 70-73, without using the side electrodes 41-44.
[0050] In drawing 4 , the through hole electrode 70 is made to follow a sheet 20-1 to 20-7, is prepared, and connects the end of the aforementioned external connection electrode 15-1 and the electrode 22 of the coil section 14, and the capacitor electrode 28. The through hole electrode 71 is made to follow a sheet 20-1 to 20-7, is prepared, and connects the end of the external connection electrode 15-2 and the electrode 26 of the coil section 14, and the capacitor electrode 29. The through hole electrode 72 is made to follow a sheet 20-1 to 20-8, is prepared, and connects the external connection electrode 15-3 and a grounding electrode 12. The through hole electrode 73 is made to follow a sheet 20-1 to 20-8, is prepared, and connects the external connection electrode 15-4 and a grounding electrode 12.
[0051] About the radio-frequency-head article which has the laminated structure of drawing 4 , drawing 5 (A) and (B) make a top and the bottom the external connection electrode 15-1 to 15-4, respectively, and show it, respectively.
(2) In the above-mentioned example, although the helical-type coil is used as an inductance of a low pass filter, the aforementioned coil may be a spiral configuration formed in the shape of a swirl by the coplanar. Moreover, you may use track elements, such as a microstrip line, as an inductance element. In this case, since a line impedance will be small and Q of a track element will fall by the bird clapper if the distance of the aforementioned track element and a grounding electrode becomes small, the composition which can take enough the distance of the microstrip line which are a grounding electrode and a track element is suitable like the composition of this invention.
(3) In the above-mentioned example, although the example of a low pass filter was given and explained, this invention can realize what demonstrates the function which demonstrated the function as the coupler which consists of an inductance element and a capacitor in addition to a filter, or a phase shifter, or compounded these.
(4) the above-mentioned example -- setting -- a ceramic green sheet -- a conductor -- although the radio-frequency-head article is manufactured by the sheet laminated layers method which forms a conductor pattern by print processes using a paste, and carries out the laminating of them, even if it uses the printing laminated layers method which also paint-izes the ceramic used as a part for a dielectric soma, and carries out a laminating by print processes altogether, manufacture of the radio-frequency-head article concerning this invention is possible
[0052]
[Effect of the Invention] Since according to the claim 1 it is near the field used as the opposite side of the field in which the external connection electrode of the aforementioned radio-frequency-head article was prepared and the grounding electrode was prepared in the interior of a radio-frequency-head article while having the external connection electrode on one front face of a radio-frequency-head article, in the situation in recent years of not preparing a conductor pattern in the bottom of parts by the miniaturization of parts, a shielding effect equivalent to the

conventional shield structure is obtained. Moreover, by not preparing a grounding electrode in the side which prepared the external connection electrode, the miniaturization of a part shape is possible and the radio-frequency-head article in which chip size mounting is possible can be offered.

[0053] According to the claim 2, by the passive element in the aforementioned multilayer substrate, the function which compounded the function of a filter, a coupler, or a phase shifter or these is given, and these miniaturizations and chip size mounting are attained.

[0054] According to the claim 3, among the passive elements in a multilayer substrate, since you made it unevenly distributed in the side which has a grounding electrode in the direction of a laminating of the multilayer substrate which constitutes the aforementioned radio-frequency-head article and the grounding electrode was prepared as some capacitors, the use efficiency of a capacitor of the pattern in the space in a multilayer substrate improves, and the further miniaturization of parts of it is attained.

[0055] According to the claim 4, among the passive elements in a multilayer substrate, since you made it unevenly distributed in the side in which an external connection electrode without a grounding electrode is formed, it prepared in the direction of a laminating of a multilayer substrate and the distance to a grounding electrode is securable enough, an inductance element prevents the fall of Q of an inductance element, and can discover the good property of a radio-frequency-head article.

[0056] Since the lap in the laminating method was avoided and formed to the pattern which forms the aforementioned inductance element for the conductor pattern which forms the aforementioned external connection electrode according to the claim 5, the fall of Q of an inductance element can be prevented.

[0057] According to the claim 6, the external connection electrode prepared in the side of the aforementioned radio-frequency-head article constitutes a part of circuit which constitutes the aforementioned radio-frequency-head article, and since it connected with the external connection electrode prepared in the aforementioned front face electrically, the external connection electrode prepared in this side can make a radio-frequency-head article serve a double purpose as a conventional surface mounted device. Moreover, when it uses as a conventional radio-frequency-head article, as for the radio-frequency-head article of this invention, the part by which the external connection electrode is newly formed in the base side of parts, and the fixing intensity to the mother board of parts increase.

[0058] According to the claim 7, since the solder bump was formed on the external connection electrode of the front face of a radio-frequency-head article, soldering to the mother board of a radio-frequency-head article becomes easy.

[0059] According to the claim 8, by the laminating method of the aforementioned multilayer substrate, while is not exposed and the aforementioned grounding electrode serves as [the layer in which the grounding electrode of a radio-frequency-head article was formed] an outermost layer of drum. And in order to manufacture a radio-frequency-head article by carrying out the laminating of a conductor and the base material so that the layer in which the external connection electrode of the aforementioned radio-frequency-head article was formed may turn into an outermost layer of drum of another side which the aforementioned external connection electrode exposes by the laminating method of the aforementioned multilayer substrate, An electrode pattern does not need to form an electrode pattern anew after a laminating in the field of the direction of a laminating of a radio-frequency-head article that what is necessary is just to form to substrate material layers, such as each green sheet in front of a laminating. Moreover, the protective layer to the exterior is also simultaneously formed in the grounding electrode used as the screening electrode of a radio-frequency-head article, and it is not necessary to prepare a protective layer after a laminating, and there are few processes and it ends.

[0060] According to the claim 9, in order to carry out plating processing of the external connection electrode prepared in the side of the aforementioned radio-frequency-head article, and the external connection electrode prepared in the front face at the same process, it can be made a side electrode usable also as a conventional surface mounted device, and a number does not increase as a galvanizer, either.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The Y-Y cross section of drawing 3 (A) showing one example of the radio-frequency-head article according [(A)] to this invention and (B) are the representative circuit schematics showing the low pass filter which is an example of the circuit realized with the radio-frequency-head article of this invention.
[Drawing 2] It is the laminated-structure view showing one example of the radio-frequency-head article of this invention.
[Drawing 3] (A) meets the external view of this example, (B) meets the Y-Y line of (A), and it is a mounting cross section to the shown mother board.
[Drawing 4] It is the laminated-structure view showing other examples of the radio-frequency-head article of this invention.
[Drawing 5] (A) and (B) are the external views shown [the example of drawing 4] by making an external connection electrode into the bottom upwards, respectively.
[Drawing 6] (A) is the external view of the conventional radio-frequency-head article, and (B) is the X-X cross section of (A).
[Description of Notations]
A radio-frequency-head article, a 11:multilayer substrate, 12:grounding electrode, 13 : 10: The capacitor section, 14: The coil section, a 15-1 - 15-4:external connection electrode, 16 : A space layer, 20-1 to 20-9 : A sheet, 22 and 24, the electrode of 26:coil, 23, 25:through hole electrode, 29[27 -]:capacitor electrode, 44[41 -]:side electrode, 60:mother board, 61, 63:electrode, 62, 64:solder, 73[70 -]:through-hole electrode, 101, a 102:terminal, a 103:inductance element, 104-106: Capacitor

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[Translation done.]

* NOTICES *

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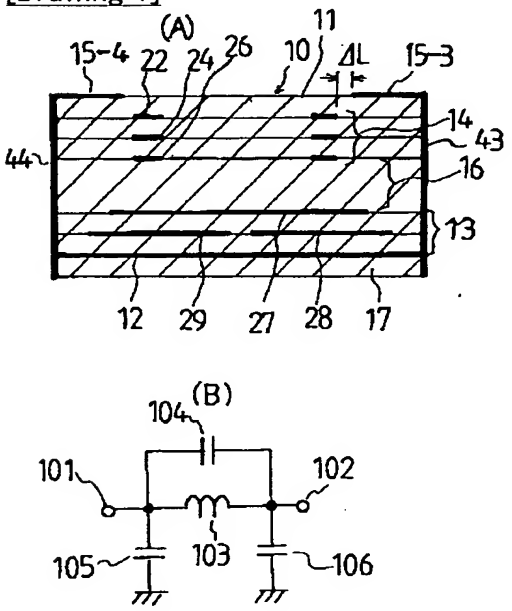
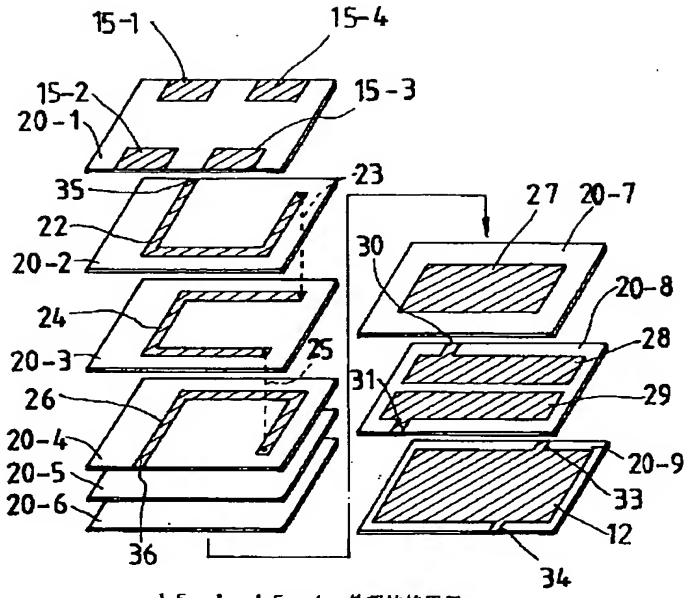
DRAWINGS

[Drawing 1]



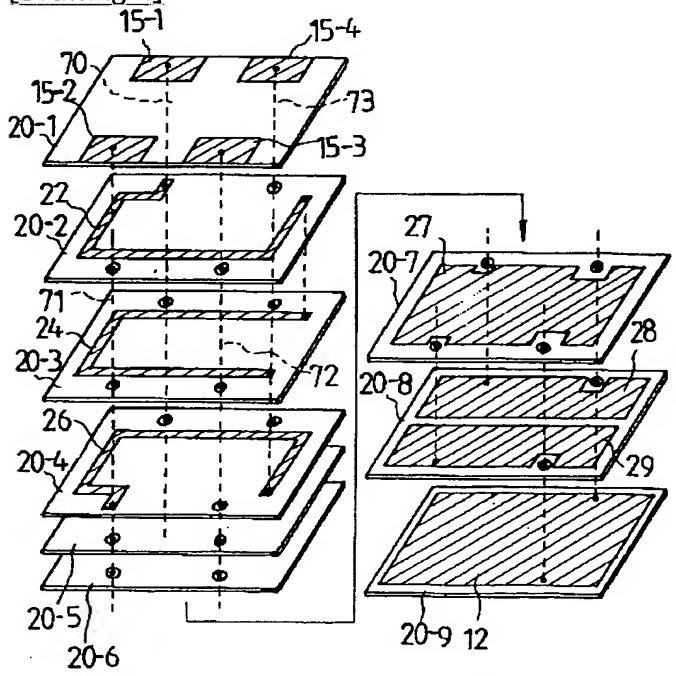
１０：高周波部品、１１：多層基板、１２：接地電極
１３：コンデンサ部、１４：コイル部
１５－３、１５－４：外部接続電極
１６：スペース層、２２、２４、２６：コイルの電極
２７～２９：コンデンサ電極、１０１、１０２：端子
１０３：インダクタンス素子、１０４～１０６：コンデンサ

[Drawing 2]



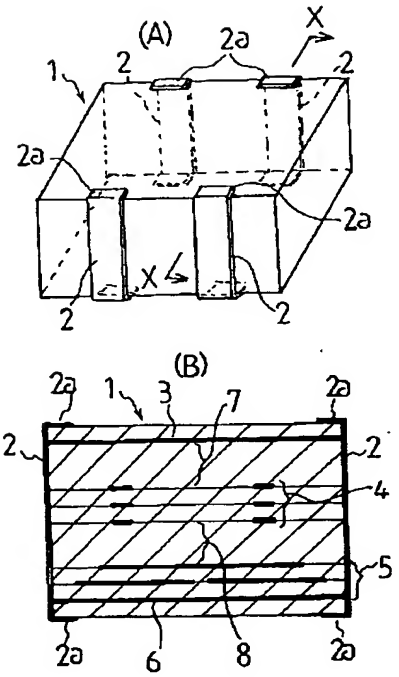
１５－１～１５－４：外部接続電極
２０－１～２０－９：シート
２２、２４、２６：コイルの電極
２３、２５：スルーホール電極
２７～２９：コンデンサ電極

[Drawing 4]

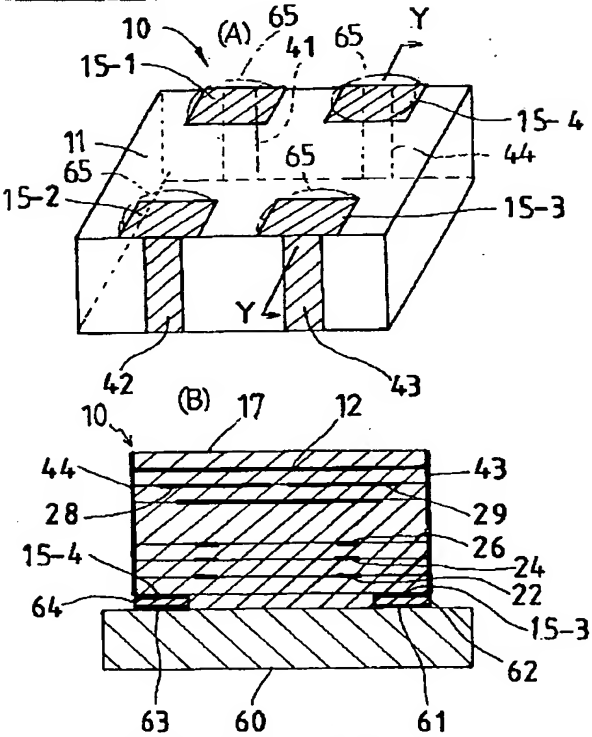


１５－１～１５－４：外部接続電極
２０－１～２０－９：シート
２２、２４、２６：コイルの電極
２３、２５：スルーホール電極
２７～２９：コンデンサ電極
７０～７３：スルーホール電極

[Drawing 6]

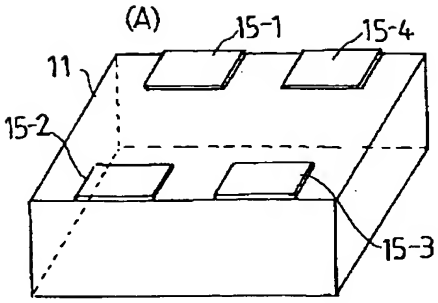


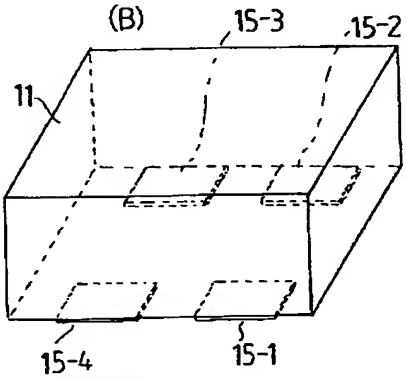
[Drawing 3]



１０：高周波部品、１１：多層基板
１２：接地電極、１３：コンデンサ部
１４：コイル部、１５－１～１５－４：外部接続電極
２２、２４、２６：コイルの電極
２７～２９：コンデンサ電極
４１～４４：側面電極、
６０：マザーボード、６１、６３：電極
６２、６４：半田

[Drawing 5]





１１：多層基板
１５－１～１５－４：外部接続電極

[Translation done.]